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CONTRIBUTION TOWARDS A MONOGRAPH OF THE OEDEMERIDAE 13. THE "FRAGILIS" COMPLEX OF THE GENUS *OXACIS*¹

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There is little doubt that the genus *Oxacis* LeConte, as now restricted (Arnett, 1958), is a very difficult genus to understand. The species are close and variable. In advance of the publication of a revision of the species of this genus occurring in the North and Central American parts of its range, the following descriptions are published so that names will be available for other studies pending the publication of the revision.

There is included here a key to the species of the part of the genus involved in this study. This key is based on characters that, because of the variation of many of the species, must be used with great caution. Every attempt has been made to use reliable characteristics, but color characteristics are all that are available as usable key characters. Fine details of shape and proportions help to define the species, but such features cannot be used in a key. A key to all of the members of the genus will appear in the generic revision. The group of species here considered may be called the "fragilis" complex. The species of the genus *Oxacis* offer a good example of the taxonomic problems involved in closely related species as described by Brown (1959).

¹ The previous part of this series, no. 12, was published in 1957, *Coleopt. Bull.*, 11: 1-8.

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METHODS.—Included with these descriptions is a discussion of the intra-specific variation of the species. This is an attempt to overcome the limitations of the holotype method of description, and at the same time recognize the need for a means of tying nomenclature objectively to the species as we know them, and to bring into "alpha" taxonomy some aspects of "gamma" taxonomy not always considered. In this way it is possible to place the holotype in the population series. It will be seen that further variation studies can be added easily as additional material becomes available if the type series of the species are characterized sufficiently. It also permits an easier, more convenient means of recording population data which will be of later use, and eventually will lead to a full characterization of the species.

In order to conserve space, detailed locality data which includes collectors names, and location of material, are not included in these summaries. However, these data are recorded in the files of the author. Processed copies of the data on all collections studied are deposited with each collection and are available in this way to all future students of the group. Specimens lacking adequate locality data are not considered in these studies. This includes most old specimens with nothing more than state or county labels. It is necessary, of course, to use such material for purely morphological studies, but with the amount of good material now available, it is believed that further consideration of poor material, in general, is a great waste of time.

Measurements in this paper (fig. 2) are taken as follows: total length (T.L.) is computed by summation of the length of the head (H.L.) from the apex of the labrum to the posterior margin of the eyes, the pronotum (P.L.), and the elytra (E.L.). Width is taken at the widest part of the body, which in the case of this group is the sum of the width of the basal portion of each elytron ($E.W. \times 2$) at its widest point. Pronotum length is measured from the anterior to posterior along the midline; width (P.W.) is measured at its widest point. Mandible length (M.L.) is computed by measuring the distance from its base to the apex of the left mandible in dorsal (anterior) view as the longest distance (curvature is not considered because of the difficulty of taking such measurements routinely). Elytra length is measured as the distance from the base of the elytra at the posterior lateral angle of the scutellum to the apical most portion of the elytra. Elytra width is computed as the sum of the width of the basal portion of each elytron at its widest point (which is also the width of the body in this case).

KEY TO THE SPECIES OF *OXACIS* LE CONTE OF
NORTH AND CENTRAL AMERICA. I. THE "FRAGILIS" COMPLEX

1. Pubescence of elytra of two distinct colors and texture..... 2
 Pubescence of uniform, or nearly uniform color throughout..... 3
- 2(1). Coarse brown, erect hairs scattered throughout white, more recumbent hairs on elytra in proportions varying from nearly equal parts of each to a very few erect brown hairs located mainly toward apex and sutural areas of elytra (fig. 1)..... **bitomentosa**, n. sp.
 Brown hairs in patches on elytra otherwise covered with white hairs, giving surface a variegated appearance..... **variegata** Champion
- 3(1). Color pale to tan or yellow, or if brownish, body wide and pubescence coarse; elytra with or without black stripes; antennal segments may be short and fusiform..... 4
 Color fuscus, orange-red and piceus, entirely dark, or if pale, body not immaculate, usually narrow; antennal segments elongate and parallel sided.....
Not "fragilis" complex
- 4(3). Antennae with segments fusiform, short and broad in shape (fig. 3); body usually very pale in color, immaculate..... **megathoracica**, n. sp.
 Antennae with segments elongate, parallel sided; body pale to tan or yellow, with or without distinct black markings..... 5
- 5(4). Body pale to tan or light brown, immaculate..... 8
 Body yellowish, always with blackish to dark brownish markings..... 6
- 6(5). Elytra without black or dark brown stripes; body entirely reddish-yellow except for apex of femora and remainder of legs and antennae black.....
constricticollis Champion
 Elytra with a distinct narrow black or dark brown stripe on each elytron..... 7
- 7(6). Black stripe on each elytron entire..... **bilineata** Champion
 Black stripe on each elytron absent at basal half except for small black spot at base..... **pictipennis** Champion
- 8(5). Color pale; pubescence fine, surface somewhat shiny..... **fragilis** Horn
 Color tan to light brown; pubescence coarse, surface dull..... **xerensis**, n. sp.

***Oxacis bitomentosa*, new species**

The tan color, coarse, depressed white hairs and more or less evenly distributed suberect, stout brownish hairs readily separate this species from all other members of the genus. It has somewhat the appearance of *O. variegata* Champion from Central America, and is very close in appear-

ance to *O. xerensis*, n. sp., but differs from both species by the presence of and distribution of the brown hairs.

HOLOTYPE.—NEVADA, Clark Co., Colorado River Canyon, R. E. Blackwelder, April 22, 1930 (deposited in the United States National Museum collection, type no. 65085).

DESCRIPTION OF THE HOLOTYPE.—Male. Length: 10 mm.; width: 2.4 mm.

Head: length/width ratio, .840; surface finely, shallowly punctate, space between punctures microrugose. Antennae 7.5 mm. in length; second segment one-half length of the third; segments five to eleven four times as long as broad, parallel sided, segments one to four broader apically than basally, each segment with several erect setae in addition to recumbent clothing setae. Eyes elongate oval, slightly emarginate anteriorly; eyes in dorsal view set farther apart than their width in this view. Mandibles: head length/mandible length ratio 1.500; curved, slender, apices acute, apices not deflexed. Maxillary palpi with the apical segment elongate, the sides nearly parallel.

Pronotum: length/width ratio, 1.140; sides sharply constricted at the middle, anterior half rounded, posterior half with sides nearly parallel; punctures nearly the same as those of the head. Legs normal, slender, tibial spurs prominent; claws entire. Elytra length/width ratio: 2.833; surface shallowly punctate.

Abdomen shiny, surface subrugose; apex of fifth visible sternite slightly emarginate.

Pubescence of two types, the dominant body setae are recumbent, long, coarse, white; irregularly interspersed and suberect, brownish to blackish, stouter setae comprising about thirty percent of vestiture of the basal portion of the elytra (fig. 1).

Color: tan with chestnut stains on vertex, sides of pronotum and visible abdominal sternites three to five; apices of mandibles piceus.

Male genitalia: normal for the genus; no specific characters apparent.

ALLOTYPE.—Same data as holotype. Female. Length: 12.4 mm.; width 3 mm. The allotype resembles the holotype in all respects except that the apex of the fifth visible sternite is somewhat less emarginate. The various ratios are as follows: Head length/width ratio: .830; head length/mandible length ratio: 1.294; pronotum length/width ratio: 1.126; elytra length/width ratio: 2.800.

PARATYPES.—33; 8 males, 25 females. Paratypes are designated from the following localities: *United States*: NEVADA, Clark Co., Colorado River Canyon, 1 male (type locality); CALIFORNIA, Inyo Co., Death Valley, 3 females; San Bernardino Co., Baker, 1 female; Riverside Co., Twenty-nine Palms, 2 males, 3 females; San Diego Co., Borrego Valley, 1 female; Imperial Co., Potholes, 1 female; ARIZONA, Yuma Co., Yuma, 4 females; Wellton, 1 female; *Mexico*: BAJA CALIFORNIA, San Felipe, 2 females, 1 male; Bahia de los Angeles (also labelled Angeles Bay), 4 females; Isla San Francisco, 1 female; La Paz, 1 female; SONORA, 5 mi. w. Guaymas, 1 male; SINALOA, Los Mochis, 3 males, 2 females.

Larvae: Unknown.

BIOLOGY.—Adults have been collected as early as April 9th and as late as June 7th. The majority of specimens were collected during late April and early May. This seasonal appearance holds true throughout the range of the species. These dates roughly correspond with the end of the spring rains throughout the distribution of this species. This may indicate that the appearance of the adults corresponds to the flowering of certain plants, but no data are available which will link this species with any wild plants. However, the specimens recorded from Los Mochis were intercepted at Nogales, Arizona in a shipment of tomatoes.

DISTRIBUTION.—(Map 1). This species is strictly confined to the western limits of the Sonoran Desert, in the Colorado and Gulf Coast subdivision, with the exception of the specimens collected in Death Valley.

VARIATION.—None of the population samples are large enough to make extensive statistical analyses. The total length of the males studied is obviously considerably less than the length of the females. Likewise the male pronotum length/width ratio is higher than that of the female. Unfortunately only three populations studied contained males. Of these, two show striking sexual dimorphism of total length, but the Los Mochis population contains males that are almost the same length as the females. In general, the specimens are darker in the southern part of the range, but this is not true in all cases. Other variations are not considered significant on the basis of these small numbers.

This species closely resembles many of the variants of *O. xerensis*, but the two types of clothing setae will separate them as mentioned above.

***Oxaxis megathoracica*, new species**

The pale color, fusiform antennal segments, and the broad pronotum will serve as recognition characters for this species.

HOLOTYPE.—ARIZONA, Yuma Co., Ehrenberg, June 19, 1946 (W. F. Barr).

DESCRIPTION OF THE HOLOTYPE.—Male. Length: 9.4 mm.; width: 2.2 mm.

Head: length/width ratio, .851; surface very shallowly punctate, space between punctures microrugose. Antennae 5.5 mm. in length; second segment one-half the length of the third; segments three to ten three times as long as wide, segment eleven one and one-half times as long as the tenth; each segment fusiform (fig. 3). Eyes reniform, in dorsal view set farther apart than the width in this view. Mandibles: head length/mandible length ratio, 1.538; strongly curved, apices slender, not deflexed. Maxillary palpi with the apical segment elongate, sides nearly parallel, slightly broader near base.

Pronotum: length/width ratio, 1.039; broadly rounded anteriorly, constricted behind, gradually narrowing to the base; surface somewhat more deeply punctate than the head, area between punctures nearly smooth. Legs normal for the genus, slender,

tibial spurs prominent, claws simple. Elytra: length/width ratio, 2.863; surface shallowly rugose-punctate.

Abdomen dull, surface rugose; apex of the fifth visible sternite broadly truncate; fifth tergite scoop-shaped forming a hood over the genitalia.

Pubescence moderate, white, recumbent, denser near the apices of the elytra and along the sides.

Color: pale tan, immaculate.

Male genitalia: normal for the genus; no specific characteristics apparent.

ALLOTYPE.—Same data as holotype. Female. Length: 10.2 mm.; width 2.4 mm. The color of the body of the female is somewhat darker than that of the male. The apical segment of the maxillary palpus is decidedly triangular, widest near the middle. The surface of the head and thorax between the punctures is more definitely microrugose.

PARATYPES.—7; 6 males, 1 female. Paratypes are designated from the following localities: *United States*: ARIZONA, Prescott, 1 male; CALIFORNIA, Brawley, 3 males; Imperial Co., 1 male; San Diego Co., 1 female; *Mexico*: BAJA CALIFORNIA, Bahia de los Angeles, 1 male.

Larvae: Unknown.

BIOLOGY.—Adults have been taken from May 9th to July 14th.

DISTRIBUTION.—(Map 1). This species may be confined to the Sonoran Desert region, but none of the locality data is precise enough to indicate what life zones this species occupies. Any one of the above localities could indicate mountain top distribution as well.

VARIATION.—The short series upon which this species is based indicates only tremendous size variation. The smallest specimen measures a mere 4.1 mm. in length; the largest 11.3 mm. Both of these specimens are males, and the size of their genital apparatus is approximately the same, which leaves the small specimen with genitalia way out of proportion to the rest of its body. This is to be expected when size variation is due to larval nutritional differences but certain structures are under genetic control. Otherwise the small specimen would be an abnormal mutant or a representative of at least a different and isolated population. This constant size regulation is not restricted to the genitalia. The setae on the small specimen are actually nearly the same size as those of the large specimen, not proportionately smaller as might be expected.

This species resembles *O. fragilis* in general appearance and color. It may be readily separated from the latter, however, by the shape of the antennal segments, those of *O. megathoracica* being short and fusiform in contrast to the longer and parallel sided segments of *O. fragilis*.

Oxaxis xerensis, new species

(FIGURE 2)

This species resembles *O. bitomentosa* in color, size, and shape, but may always be separated from the later by the absence of any dark brown, semierect setae mixed with the pale clothing setae.

HOLOTYPE.—BAJA CALIFORNIA, 15 miles north of Punta Prieta, Michelbacher and Ross, July 29, 1938 (deposited in the California Academy of Sciences collection).

DESCRIPTION OF THE HOLOTYPE.—Male. Length: 10.9 mm.; width: 2.1 mm.

Head: length/width ratio, .960; surface with punctures shallow, small, area between punctures microrugose. Antennae 7.6 mm. in length; second segment one-half length of the third; segments five to eleven five times as long as broad, each segment very slightly expanded apically, each segment with several short, erect setae in addition to recumbent clothing setae. Eyes moderate, reniform, set farther apart than their width in dorsal view. Head length/mandible length ratio: 1.484; mandibles broadly curved, apices subacute, not deflexed. Maxillary palpi long, the apical segment narrowly triangular, widest near the middle.

Pronotum: length/width ratio, 1.207; sides not sharply constricted at the middle; surface shallowly, finely punctate, punctures somewhat coarser than those of the head, area between punctures microrugose. Legs normal for the genus; slender; tibial spurs prominent; claws slender. Elytra: length/width ratio, 3.467; surface shallowly rugose-punctate.

Abdomen dull, subrugose; fifth visible sternite apically subtruncate, slight emargination perceivable.

Pubescence moderately coarse, moderately dense, recumbent white clothing setae.

Color: uniformly brown.

Male genitalia.—Normal for the genus; no specific characteristics evident.

ALLOTYPE.—Same data as holotype. Female. Length 9.2 mm.; width 2.1 mm. Head length/width ratio: 1.047; head length/mandible length ratio: 1.760; pronotum length/width ratio: 1.232; elytra length/width ratio: 2.870. The female agrees with the holotype in all essential features except for the size differences and the shape of the fifth visible abdominal sternite which is apically slightly produced, without emargination.

PARATYPES.—19; 8 males, 11 females, all the same data as the holotype and allotype.

Larvae: Unknown.

BIOLOGY.—The series upon which this species is based was collected on July 29, 1938. See below for further discussion of seasonal appearance. No further biological information is available except that it is evident that this species prefers very arid localities.

DISTRIBUTION.—(Map 1). In addition to the type series, the following specimens are presently considered to be the same species. They are not designated as paratypes, however, for several reasons. Some of these population samples are sufficiently distinct to warrant further study as possible sibling species, or at least their exact placing in the evolutionary pattern of this complex remains uncertain. Included in this series is a Horn paratype of *O. fragilis*. The treatment of this specimen will remain uncertain until the population variation at this locality can be studied. It seems reasonable, therefore, to name the Punta Prieta population as a distinct species based on material that is so obviously different from the type of *O. fragilis* that there will never be a question as to its specific rank. To designate the remainder of the specimens as paratypes at this time, when there is the possibility that some at least may later be treated as separate species, seems to be a useless formality.

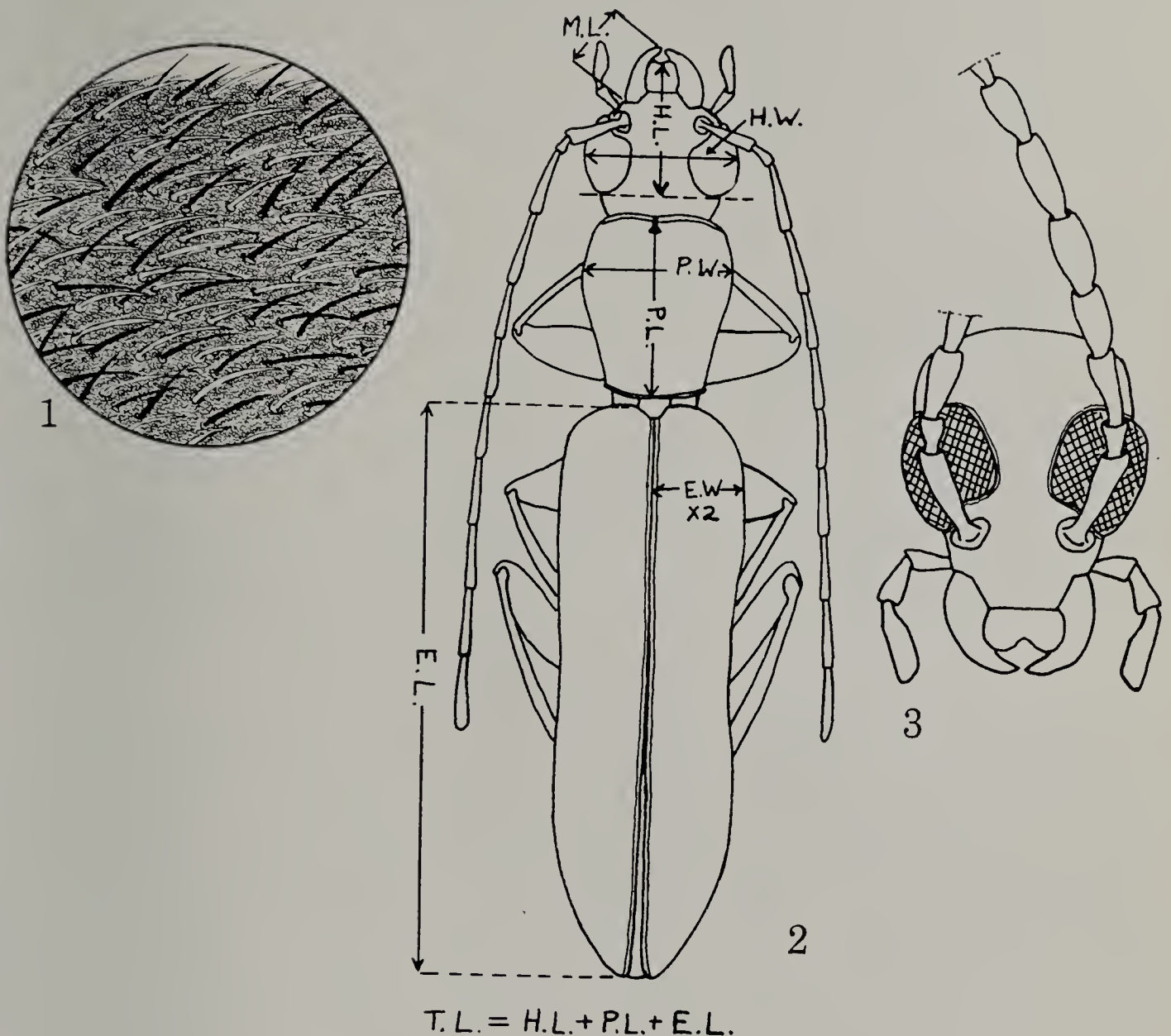
As can be seen from this list of localities, this species has much the same distribution as *O. bitomentosa* and is likewise confined to the western most portions of the Sonoran Desert.

Specimens examined.—65: 17 males, 48 females; *United States*: ARIZONA, Yuma Co., Ehrenberg, 1 male, 5 females; CALIFORNIA, Riverside Co., Blythe, 2 males, 6 females; Ripley, 1 male, 1 female; Indian Wells, 2 females; Indio, 1 male, 2 females; Coachella Valley, 9 females; San Diego Co., Borrego Valley, 1 female; Imperial Co., Experiment Farm, 1 female; Holtville, 1 male, 1 female; Winterhaven, 1 male; *Mexico*: BAJA CALIFORNIA, San Felipe, 1 female; Calamajuet, 1 female (Horn paratype of *O. fragilis*); 15 mi. N. Punta Prieta (type specimens); Mesquital, 1 male, 1 female; 15 mi. N. San Ignacio, 1 female; 45 mi. N. San Ignacio, 8 males, 10 females; 20 mi. N. Comondu, 1 female; 15 mi. S. E. Arroyo Seco, 1 male, 3 females; Triunfo, 2 females.

VARIATION.—There are not enough specimens in any single population sample of this species to test statistically for population differences. However, several statistical analyses have been made to see if certain obvious differences tend to be borne out mathematically. Range and means have been plotted as a graph for each of the 19 localities represented. This seems to indicate at least three distinct population centers, described as follows.

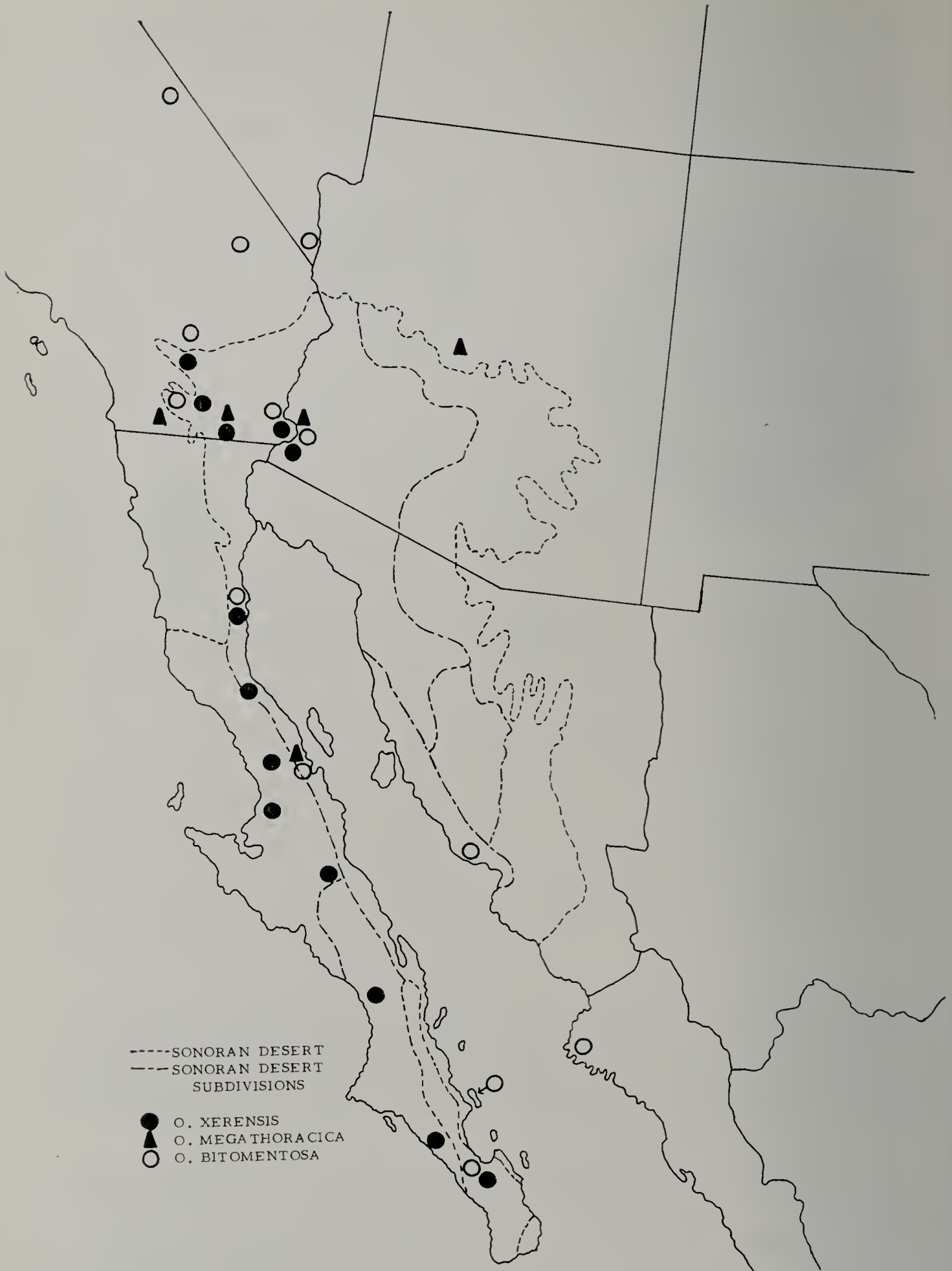
I. *Ehrenberg population*. Three samples, Ehrenberg, Arizona, Blythe and Ripley, California, with a total of 4 males and 12 females, are the extent of the known population. The clothing setae of these specimens is shorter and finer than that of the other populations. The specimens are shorter in length and have shorter mandibles. It is difficult to say where the Imperial Co., California specimens belong, but in general appearance

and ratios, they fall with this population group. These specimens were collected from July 20th to August 24th with the exception of one specimen collected May 7th. This specimen belongs to the Coachella Valley population and it can only be speculated that it is a stray.



FIGURES 1-3. FIG. 1.—A portion of an elytron of *Oxacis bitomentosa*, n. sp. showing the two colors of clothing setae. FIG. 2.—dorsal view of *O. xerensis*, n. sp., showing the points of measurement. FIG. 3.—the head of *O. megathoracica*, n. sp., showing the shape of the antennal segments, in part.

II. *Coachella Valley population*. The known population consists of Indian Wells, Indio, Coachella Valley, and Borrego Valley, with a total of 1 male and 14 females. The clothing setae are long and coarse; the total length approximates that of the San Ignacio population. The head length/mandible length ratio appears to be extremely variable, but tends to be smaller than that of the Ehrenberg population, indicating that the mandibles are larger. The pronotal length/width ratio appears to be the most uniform feature of this species. The greatest difference exhibited by this



MAP 1.—The Sonoran Desert and adjacent territory showing the distribution of three new species of *Oxacis* LeConte. The boundaries of the desert and its subregions are adapted from Shreve, 1951.

population seems to be the head length/width ratio. The head is usually broader than long in these, as opposed to the longer than broad head of the San Ignacio population. To test this, the t test was applied to the Coachella Valley and San Ignacio samples. This test shows that the mean differences are real and the null hypothesis can be rejected. This gives reason for considering the two populations as distinct. To further test this, the F test was applied to determine if it was possible to pool variances, again with positive results. The specimens were collected from April 24th to June 25th.

III. *San Ignacio population*. The Baja California specimens for the most part seem to be a separate, but extremely variable population. Almost all of the specimens have the characteristic long and relatively coarse clothing hairs. The head is usually longer than wide, the mandibles are moderate in length, and the elytra are much longer than wide. The few specimens from the extreme southern part of the known range, those from Comondu and Arroyo Seco are broader and tend towards the general appearance of the Ehrenberg population (which may indicate a central-peripheral pattern of distribution). The specimens were collected from July 13th to July 29th.

DISCUSSION

A great deal more needs to be known about the species described in this interesting complex before it can be determined exactly what their evolutionary status may be. These are close species and occupy an area of extremely diverse habitats. It is not surprising then, that they are difficult to interpret. The limited number of specimens make it possible to do little more than speculate. The numerical data upon which these speculations are based are filed for future use and are not presented here.

A careful study of the available information shows the following, which is also a summary of this paper:

- 1) Color characteristics have little positive value in the description of the species in this complex except in the case of the two Central American species which have distinctive, clearly delimited, and non-variable maculations. Color can be used as an aid to identification by offering recognition patterns useful in the preliminary sorting of specimens.

- 2) The populations tend to vary geographically with some indication of the central-peripheral population pattern (Brown, 1957, 1958) in *O. xerensis* at least.

- 3) There appears to be three intergrading populations of at least one species, *O. xerensis*. These populations show vague morphological differences, which are evident only after the specimens are arranged geo-

graphically, measured, and the means and range of variation studied. Statistical tests, such as the *t* and *F* tests indicate that a normal variation curve would be present if enough specimens were available. From these data it is evident that three factors may be correlated: morphological difference, the season of appearance of the adults, and the rainy season (Turnage and Mallery, 1941) for the area. It is suspected that elevation differences (which also indicate differences in floral ecology) could also be correlated if these data were available with the specimens.

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A REVIEW OF THE TAXONOMY OF THE GENUS EURYDERUS LE CONTE, 1848. WITH NOTES ON THE NORTH AMERICAN DAPTI (OF AUTHORS). (CARABIDAE: HARPALINI)

By GEORGE E. BALL ¹

I. INTRODUCTION

Among an assortment of carabid beetles from New Mexico which I received for identification some years ago was a specimen of the genus *Euryderus*, which I attempted to determine. I soon found that this was going to be a difficult task, for the specimen did not seem to have the necessary combination of characters to fit any of the couplets in the most recent key available (Casey, 1914: 54-57). The attempt to solve this problem led to the study which is presented in the following pages.

II. ACKNOWLEDGEMENTS

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